(12) **United States Patent**
Kaplan et al.

(10) **Patent No.:** **US 9,171,317 B2**
(45) **Date of Patent:** **Oct. 27, 2015**

(54) **BACK-CHANNEL MEDIA DELIVERY SYSTEM**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1056 days.

(21) Appl. No.: **11/981,636**

(22) Filed: **Oct. 30, 2007**

(51) **Int. Cl.**
G06Q 30/00 (2012.01)
G06Q 30/02 (2012.01)

(52) **U.S. Cl.**
CPC *G06Q 30/0241* (2013.01); *G06Q 30/02* (2013.01); *G06Q 30/0201* (2013.01); *G06Q 30/0205* (2013.01); *G06Q 30/0207* (2013.01); *G06Q 30/0242* (2013.01); *G06Q 30/0256* (2013.01); *G06Q 30/0258* (2013.01); *G06Q 30/0273* (2013.01); *G06Q 30/0277* (2013.01)

(58) **Field of Classification Search**
USPC 705/14.4, 14.41; 382/209
See application file for complete search history.

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(57) **ABSTRACT**

A back-channel media delivery system that may be used for tracking the number and type of human impressions of media content rendered by the system during the time the media was rendered is provided. The back-channel media delivery system includes a rendering device for rendering media, an environmental sensor for sensing impressions and other environmental variables and a computing device configured to play media on the rendering device, and gather data related to the external states detected by the environmental sensor. The system may include rules that interpret that data and may cause the system to custom select, tailor or control future playback of media on the system.

32 Claims, 7 Drawing Sheets
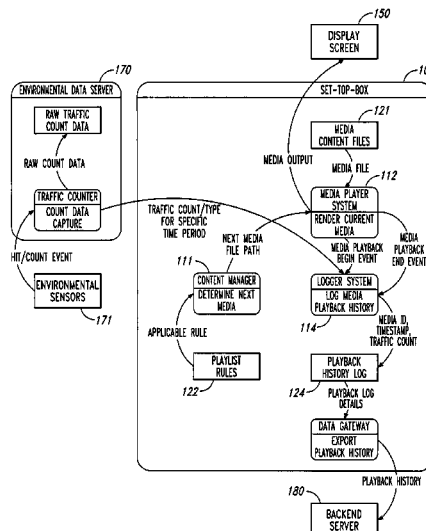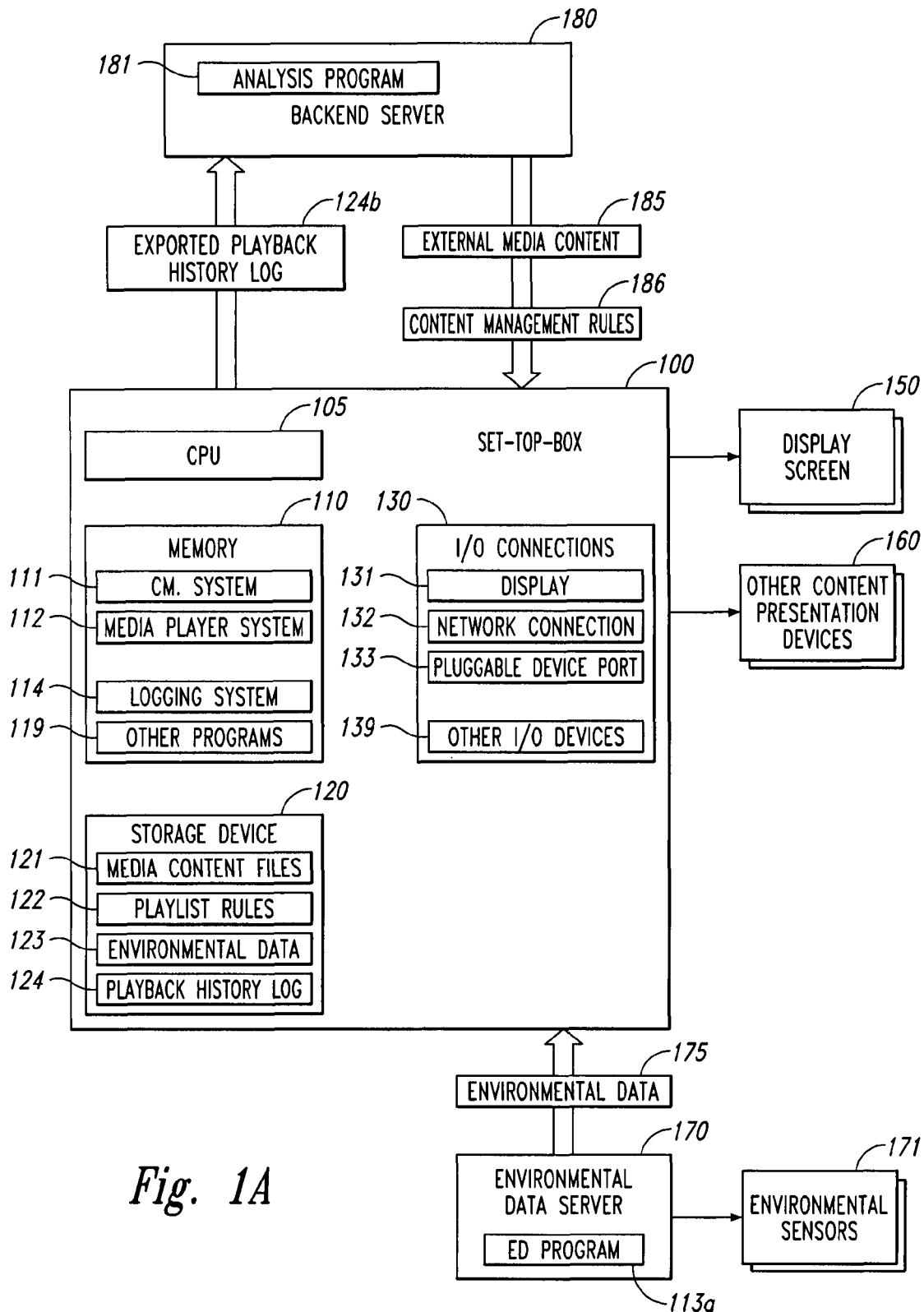
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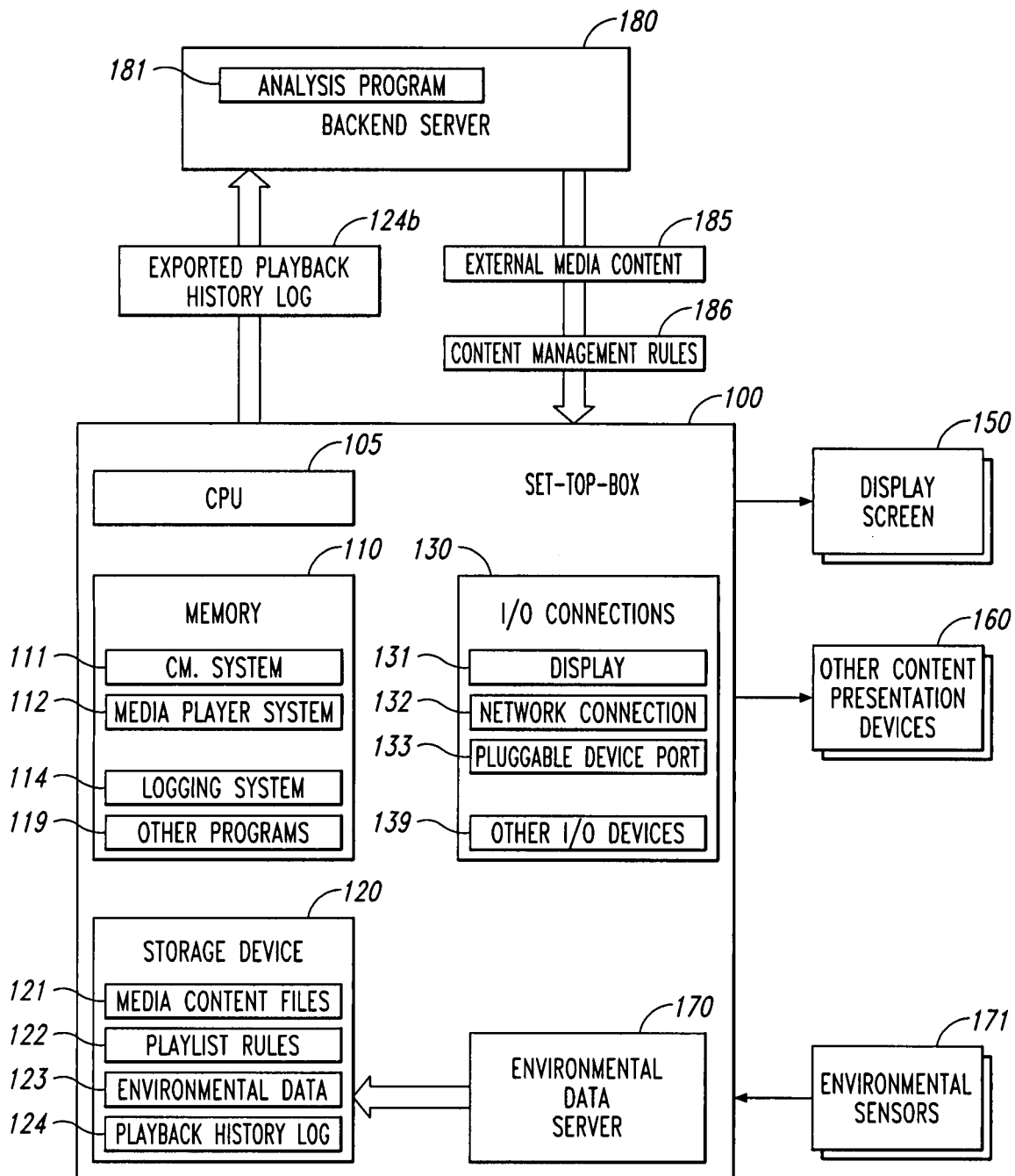|			
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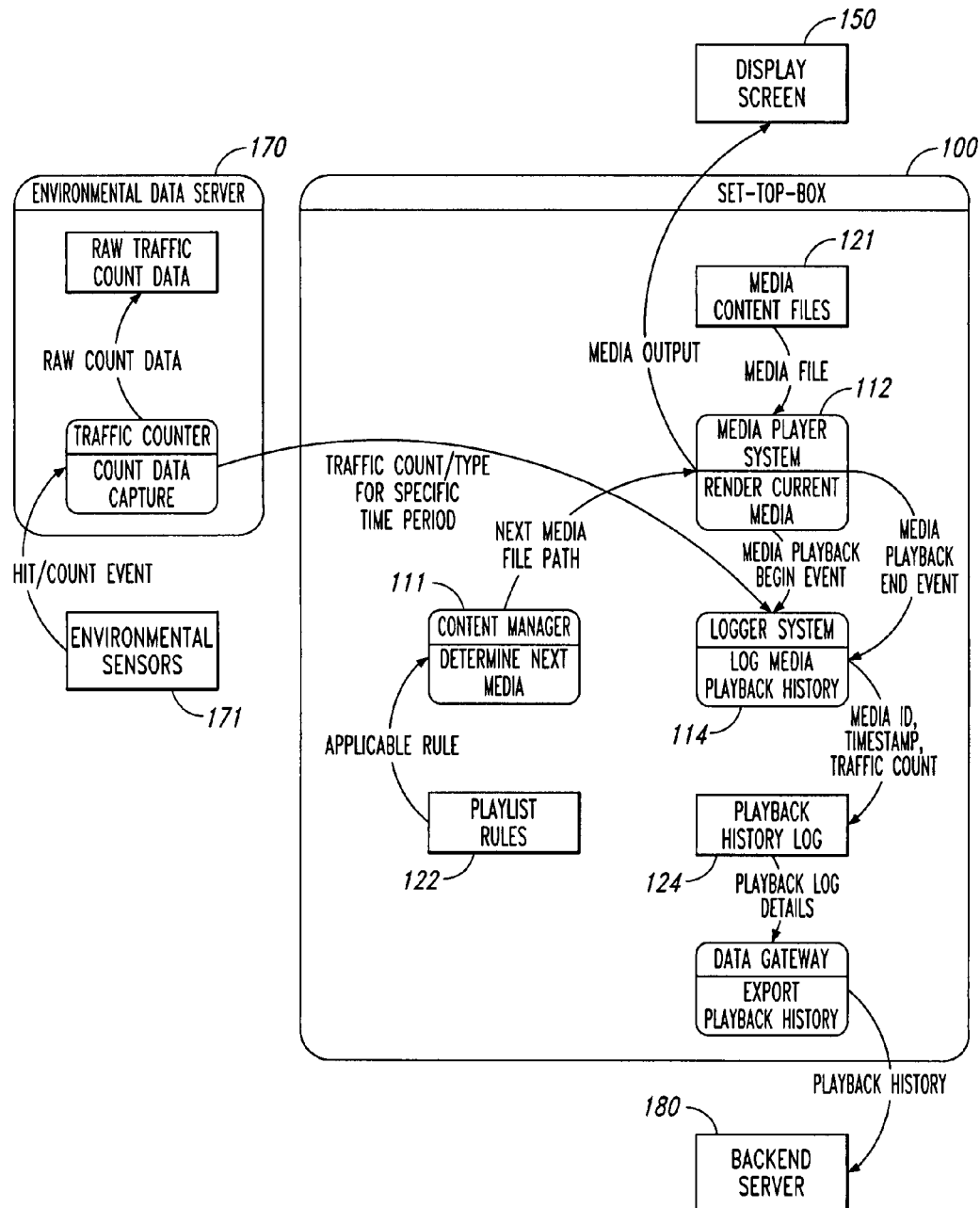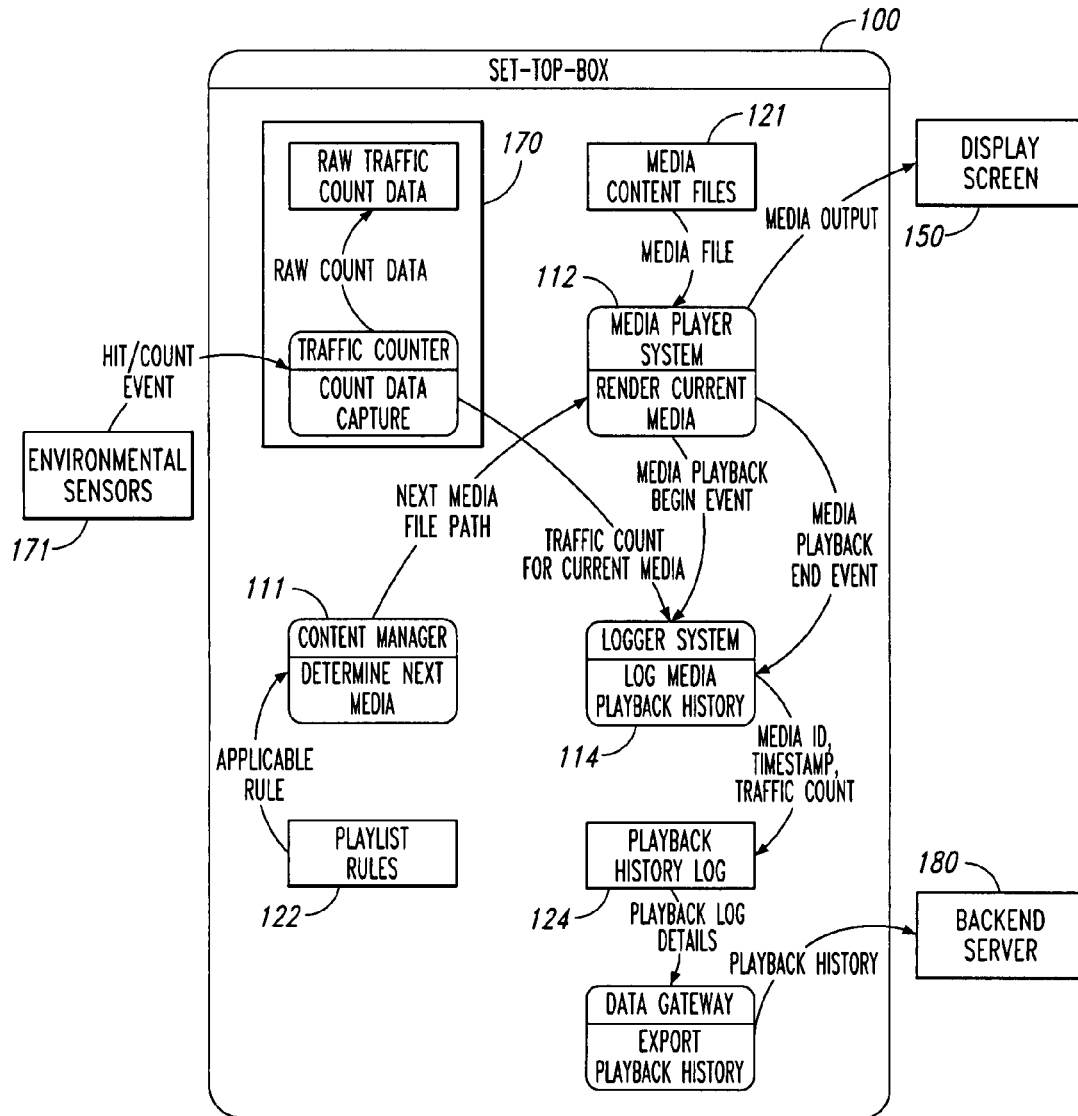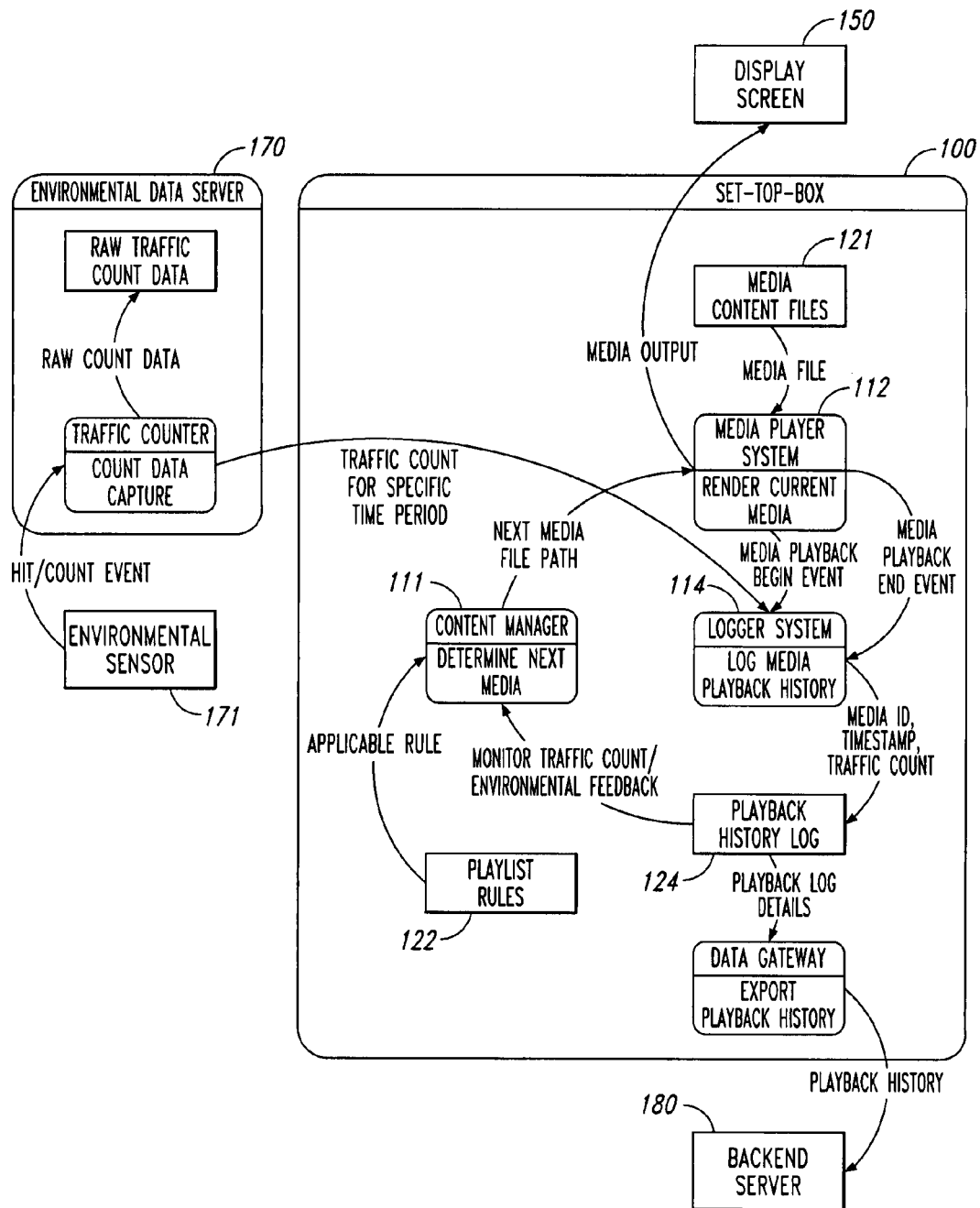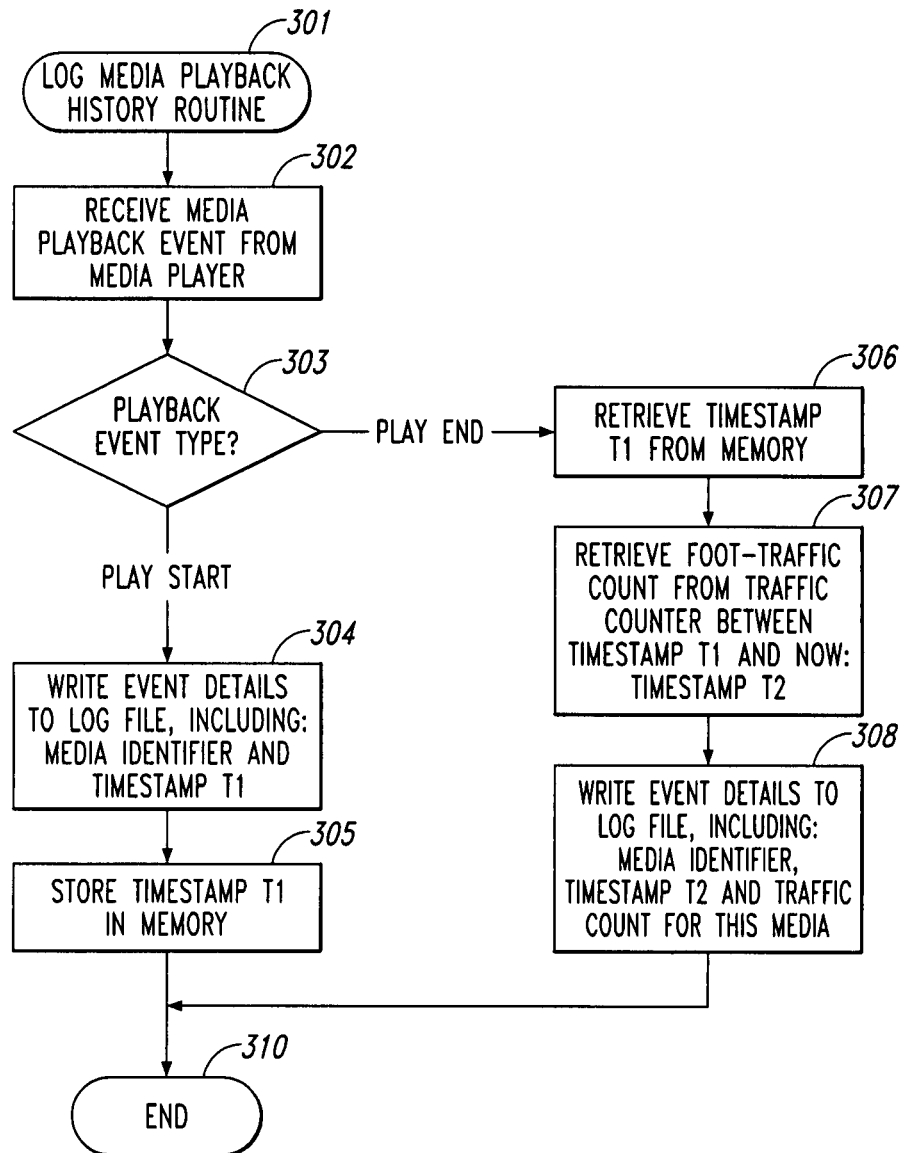
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Fig. 1A

Fig. 1B

Fig. 2A

100

SET-TOP-BOX

RAW TRAFFIC COUNT DATA

170

RAW COUNT DATA

TRAFFIC COUNTER
COUNT DATA CAPTURE

HIT/COUNT EVENT

121

MEDIA CONTENT FILES

MEDIA OUTPUT

DISPLAY SCREEN

150

MEDIA FILE

112

MEDIA PLAYER SYSTEM
RENDER CURRENT MEDIA

ENVIRONMENTAL SENSORS

171

NEXT MEDIA FILE PATH

MEDIA PLAYBACK BEGIN EVENT

TRAFFIC COUNT FOR CURRENT MEDIA

MEDIA PLAYBACK END EVENT

111

CONTENT MANAGER
DETERMINE NEXT MEDIA

LOGGER SYSTEM
LOG MEDIA PLAYBACK HISTORY

114

APPLICABLE RULE

PLAYLIST RULES

122

MEDIA ID, TIMESTAMP, TRAFFIC COUNT

PLAYBACK HISTORY LOG

124

PLAYBACK LOG DETAILS

180

BACKEND SERVER

PLAYBACK HISTORY

DATA GATEWAY
EXPORT PLAYBACK HISTORY

Fig. 2B

150

DISPLAY
SCREEN

170

ENVIRONMENTAL DATA SERVER

RAW TRAFFIC
COUNT DATA

RAW COUNT DATA

TRAFFIC COUNTER
COUNT DATA
CAPTURE

HIT/COUNT EVENT

ENVIRONMENTAL
SENSOR

171

100

SET-TOP-BOX

121

MEDIA
CONTENT FILES

MEDIA OUTPUT

MEDIA FILE

112

MEDIA PLAYER
SYSTEM
RENDER CURRENT
MEDIA

TRAFFIC COUNT
FOR SPECIFIC
TIME PERIOD

NEXT MEDIA
FILE PATH

MEDIA
PLAYBACK
END EVENT

111

CONTENT MANAGER
DETERMINE NEXT
MEDIA

114

MEDIA PLAYBACK
BEGIN EVENT

LOGGER SYSTEM
LOG MEDIA
PLAYBACK HISTORY

APPLICABLE RULE

MONITOR TRAFFIC COUNT/
ENVIRONMENTAL FEEDBACK

MEDIA ID,
TIMESTAMP,
TRAFFIC COUNT

PLAYLIST
RULES

PLAYBACK
HISTORY LOG

122

124

PLAYBACK LOG
DETAILS

DATA GATEWAY
EXPORT
PLAYBACK HISTORY

PLAYBACK HISTORY

180

BACKEND
SERVER

Fig. 2C

Fig. 3

BACK-CHANNEL
MEDIA DELIVERY
SYSTEM
400

BACKEND SERVER
440

PLAYBACK HISTORY
435

NEW MEDIA AND PLAYBACK RULE
430

MEDIA DELIVERY DEVICE
410

COMPUTING DEVICE
420

RENDERING DEVICE
425

ENVIRONMENTAL SENSORS
415

Fig. 4

BACK-CHANNEL MEDIA DELIVERY SYSTEM

RELATED APPLICATION DATA

This application claims priority to U.S. Provisional Patent Application Ser. No. 60/898,855, entitled BACK-CHANNEL MEDIA DELIVERY SYSTEM, filed Jan. 31, 2007, which applications are incorporated herein by reference.

TECHNICAL FIELD

The present invention relates to techniques for rendering media content on a media delivery device that tracks human impressions of the media content, as well as other environmental data, during the time it was rendered by the media delivery device.

BACKGROUND OF THE INVENTION

It has always been difficult for advertisers to gauge the effectiveness of their advertisements particularly where the advertising is done through traditional modes of advertising such as television or newspaper. Generally speaking, television networks and newspaper publishers have only approximate statistics on the number of viewers or readers within a given market. Newspaper publishers, for example, can approximate the number of newspapers that are read on any given day based on subscription and other sales data. Of course, every person who receives a newspaper is not going to read every advertisement within that paper. Consequently, newspaper publishers and those who purchase advertisements from the publishers have only a loose idea of how many people are exposed to or actually read their advertisements. Likewise with television advertising, the viewership of any given program, and the commercials that run during such programs, is not known with precision. The so-called 'ratings' for television programs are gathered statistically and again, calculating the number of people who are reached with any given advertisement is imprecise. Ideally, advertisers would like more substantive feedback about who and how their advertising content is being viewed.

With the rise of Internet advertising, advertisers are given more direct and immediate feedback on who is viewing their advertisements. Suppose, for example, that an advertiser purchases advertisements on the website of a major internet search engine such as Google. The advertisement provider, Google in this case, gathers data on the precise number of times that a given advertisement is actually rendered during a page view. Likewise, the advertisement provider can gather data representing the precise number of times a given advertisement is actually clicked by the viewer of the advertisement. Such feedback is invaluable because it allows advertisers to get feedback on the exact, rather than approximate, number of impressions the advertising made on the target audience. An 'impression' is any exposure a person has to an advertisement. In the context of a newspaper, an advertisement has an impression every time a person turns to the page of the paper where the advertisement is located. Since it is not possible to know with any certainty what pages of a newspaper are every actually viewed by a person, it is not possible to know with any certainty how many impressions a newspaper-based advertisement receives. A similar problem exists with television advertising because, as was discussed above, television 'ratings' are statistical estimates and calculating the number of people reached with any given advertisement is imprecise.

In addition to impression information, the feedback provided by an internet advertisement provider such as Google also provides valuable information about how effective an internet-based advertisement is in generating an inquiry (i.e. it tells you how many impressions actually result in a click on the advertisement). Data generated by, and fed back from, an advertising channel is more commonly known as 'back-channel data.' Back-channel data has increasingly become the currency driving Internet advertising business. Absolute measurement—vs. statistical analysis—is key to advertisers, corporate and content programmer confidence.

Although television, newspaper and magazine advertising channels continue to be very important, other forms of advertising such as audio, video and electronic signage in retail spaces, hotels, restaurants and other public places are becoming increasingly prevalent. Such advertising media might comprise playback of DVD's, computer generated media or animation, set-top box video and audio, satellite dish video, streaming internet protocol television ('IPTV'), still pictures, or even audio. Some such systems have the capability to report on what media content was played at what time and to schedule the time at which particular media is played. While these are very valuable controls for advertisers who wish to control their messaging, there is currently no mechanism for reporting how many people were or are exposed to an impression of such media content. Likewise, there is no mechanism for adapting the media content to account for local variables and conditions detected during media playback.

There is therefore a need for an media delivery system that gathers data about the number and type of human impressions of media content delivered by a content rendering device for cross-correlation of such impression data with the media content. Such a system may also alter the media content it delivers based on such data.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1A and 1B are detailed block diagrams of example embodiments of back-channel media delivery systems.

FIGS. 2A-2C are data flow diagrams of operation of example embodiments of back-channel media delivery systems.

FIG. 3 is a flow diagram of an example embodiment of a routine for a logging system of a back-channel media delivery system.

FIG. 4 is a high level block diagram of an example embodiment of a back-channel media delivery system.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

Techniques are described below for consolidating and correlating information about media content that is rendered at a specific time by a set-top box coupled to a display with information about the number of impressions the content made on people within some detectable proximity of the display. Although described in terms of a set-top box and display, it should be understood that such media rendering and display devices, as well as other related components, are only exemplary. Other types of media, such as still pictures or audio, may also be rendered by embodiments of the invention by an appropriate display or playback device and information about the number and type of impressions of such content likewise collected, consolidated and correlated. In particular, although embodiments of the invention are described in terms of a set-top box, it will be understood that any computing device or devices capable of performing the disclosed func-

tions of the set-top box will suffice and in no way does such a device or devices need to be literally on top of a television set. Likewise, although the media delivery system has been described in terms of advertising and advertising media, embodiments of the invention are not so limited. Embodiments of the invention may, therefore, render media that is not specifically advertising related.

FIG. 1A depicts a back-channel media delivery system according to one embodiment of the invention. The system includes a set-top box **100**, a display **150**, environmental sensors **171**, an environmental data server **170** and a backend server **180**. The set-top box **100** includes, among other things, a content management system **111**, a media player system **112** and a logging system **114**. Although discussed in terms of such components and programs, alternative embodiments of the invention are possible and it will be understood that the embodiments discussed below are for illustrative purposes only. In an alternative embodiment, the set-top box **100** may, for example, include only the content management system **111** and the logging system **114** whereas the media player system **112** is physically separate from the set-top box **100**. Indeed, any of the functions of the content management system **111**, the media player **112** and the logging system **114** may be performed by devices or systems that are physically separate.

The media player system **112**, along with the display **150**, or other content presentation devices **160**, are used to render instances of media content that embody and convey the message intended for the audience. As will be discussed more fully below, media content **121** stored in storage device **120** is selected by the content management system **111** for playback and is processed and rendered on the display **150**, or other content presentations devices **160**, by the media player system **112**. Examples of storage devices **120** include hard drives, flash memory, remote server, network attachable storage and other types of non-volatile storage and memory devices. Typically, the media content **121** is rendered as digital or analog signals which are routed to input/output (I/O) connections **130** on the set-top box **100**. For example, in the case of video media, video signals are routed to the display I/O connection **130**. Other types of media, such as audio or pictures, may be routed to other devices through their respective connectors **139**. The I/O connections **130** further include a network I/O connection **132** for routing signals between the set-top box **100** and a network. The network I/O connection **132** might be comprised of, for example, a modem connection or an 802.11x WiFi connection. A pluggable device port I/O connection **133** can be used to connect the set-top box **100** to a pluggable device, as will be described in more detail below.

The output signals are then electronically transferred from these I/O connectors **130** to an appropriate device, for example, from the display I/O connection to the display **150** or from the I/O connectors **139** to some other media content presentation device **160**. In at least some embodiments, the output and input connectors follow A/V industry standard formats (e.g., Component, Composite, VGA, DVI, and HDMI). Such embodiments of the set-top box can process and render, for example, at least one of the following digital media formats using an associated CODEC: MP3, MPEG2, MPEG4, AVI and Windows Media files such as WMA (for audio) and WMV (for video). It will be understood that these digital media formats are only for illustrative purposes and other types of media might be rendered by the media player system **112**.

The back-channel media delivery system also includes environmental sensors **171**. These sensors are responsible for detecting a myriad of environmental states, signals and con-

ditions indicative of a human impression of the media content rendered by the media player system **112**. In the embodiment of FIG. 1A, one or more sensors **171** are configured to count foot-traffic in the vicinity of the back-channel media delivery system and these sensors are connected to an environmental data server **170**. In one embodiment, the count of foot-traffic corresponds to the count of impressions. As will be discussed more fully below, the count of impressions is stored and can be used with playlist rules or for post-processing. The sensors **171** may be connected through, for example, a wired connection, which includes an Ethernet, RS-232 serial, USB or modem connection, or they may connect wirelessly through, for example, an 802.11x Wi-Fi network, or a Bluetooth or Infra-Red connection. An environmental data program **113***a* is executed on the data server **170** and processes the signals received by the environmental data server **170** from the sensors **171**. The environmental data program **113***a* can use various parameterized algorithms to determine whether the sensors **171** have detected a valid impression. The Environmental data **175**, which includes the number of valid impressions, is transmitted to the set-top box **100** for further processing and, as will be discussed in more detail below, for use by content management system **111**. In at least some embodiments, in addition to being used for counting the number of impressions, the environmental sensors **171** are capable of capturing "dwell time" of a person in an area in the vicinity of the back-channel media delivery system. Dwell time is a measure of how long the person or persons remained in proximity of the sensors **171** or back-channel media delivery system. That is, in these embodiments the sensors **171** are capable of determining when a person is in proximity to the back-channel media delivery system **100**, and additionally, determining how long they stay in proximity.

The number of valid impressions and other environmental data is transmitted to the set-top box **100** via an I/O connection **130** such as, for example, the network connection **132** or through the pluggable device port **133**. Some examples of sensor types include, but are not limited to, thermal imaging camera sensors, infrared sensors, pressure sensors, video imaging camera sensors, sonar sensors, laser sensors, audio sensors, motion sensors and RFID tag sensors. In some embodiments, the environmental sensors **171** are integrated into or attached to the display device **150**, and in other embodiments, the sensors **171** are be integrated into or attached to the set-top box **100** itself. In other embodiments, the environmental sensors **171** may be installed anywhere within a suitable vicinity of the display device **150**. For example, on the wall, ceiling or floor, within windows or doors, or self-contained and free standing.

The environmental data **175** is processed by the logging system **114** executing on the set-top box **100**. The data is stored in the storage **120** temporarily or permanently on the set-top box as environmental data **123**. In one embodiment, the media player system **112** communicates with the logging system **114** via an inter-process-communication mechanism, either in a event-driven or polling fashion, to provide playback information, such as playback state and metadata, of the media content the media player system **112** is rendering. The logger program **114** aggregates and correlates the media playback information, duration of the media content, and a timestamp of when the media content was rendered together with the environmental data **123**. The resulting output of the logging system **114** is a playback history log file **124**.

As was discussed above, the environmental data server **170** may process the signals received from the sensors to determine whether the sensors **171** have detected a valid impression. In an embodiment, such processing is done in real-time

whereby the number of impressions is determined by the environmental data server **170** as sensor data is received from the sensors **171**. In another embodiment, the sensor data and signals may be queued by the environmental data server **170** for processing at a later time. For example, after normal business hours when sensor data is not being gathered by the back-channel media delivery system (because, e.g., the store is closed), the system is relatively idle and the CPU cycles of the system may be advantageously utilized during this time. Likewise, the processing needs of the system are reduced during peak periods of environmental data gathering because the system is tasked only with storing the signals and data from the sensors **171** and not with also processing such data at that time. Such an embodiment may permit the back-channel media delivery system to use less expensive hardware since the peak processing load on the system is lower.

In an embodiment, the environmental data server **170** may be configured to detect and log environmental data that is erroneous or fraudulent. It is generally desirable that embodiments of a back-channel media delivery system gather accurate information regarding the number of impressions. In certain environments, the system may log impressions that should not be counted. For example, when placing an embodiment of the back-channel media delivery system in a store, impressions made by store employees generally should not be counted. In an embodiment, the environmental data server **170** may be configured to identify particular individuals based on various environmental data and to exclude impression counts for such persons. In an embodiment, the environmental data server **170** may work in conjunction with one or more sensors **171** that detect the presence of persons who should not be counted when gather impression data. Such sensors could, for example, detect an RFID tag embedded in the employee's name badge. Other sensors are possible as is discussed below and detection of an RFID tag is exemplary only.

In other cases, persons may wish to intentionally deceive an embodiment of the back-channel media delivery system into logging impressions that are not, in fact, valid. For example, a competitor of an advertiser may wish to trick the system into logging so many impressions or otherwise flooding the system with false data, that the advertiser is incapable of gathering any useful information about the effectiveness of their advertising. In one embodiment, the environmental data server **170** may be configured to algorithmically detect possible fraudulent impressions. For example, the environmental data server **170** may use a smoothing or filtering algorithm to remove large spikes in traffic when they may indicate attempts are being made to deceive the system.

In other embodiments, the back-channel media delivery system collects and logs data that can be accessed by a user and auditors. This may be desirable for an external auditor to confirm that the data sensed and collected by the system is accurate. An example of gathering audit data includes capturing and storing a photograph every 30 seconds that can be compared with foot-traffic counts obtained using a video camera environmental sensor **171** to confirm that the video sensing technology accurately counts foot-traffic. Other techniques of gathering audit data for verification of data collected by the back-channel media delivery system can be used as well.

Although a back-channel media delivery system will typically detect and log valid impressions of delivered media, embodiments of the back-channel media delivery system may also use non-automated counting mechanisms. In one such embodiment, the sensors **171** could include a video camera of the vicinity of the back-channel media delivery system and

the video footage of that camera could be routed to actual humans who watch the video and manually count the number of impressions on the system.

As previously discussed, instances of media rendered by the back-channel media delivery system may include a variety of different types of media such as video, audio or still pictures. In one embodiment, such media is managed by the content management system **111** which is part of the set-top box **100**. The content management system **111** enables a user to define playlist rules **122** that govern what media content **121** is to be loaded onto the storage **120** of the set-top box **100** for playback as well as for defining playlist rules that govern when or how often instances of media content are to be rendered on the display device **150** or other content presentation devices **160**.

In some embodiments, the playlist rules that govern the playback of media content, along with the media content files, are transferred onto the set-top box **100** from an external location such as another networked computing device commonly known as the backend server **180**. In other embodiments, where network connectivity is not available, such rules and media content may be transferred from an external data store onto a removable memory storage device (not shown) (e.g., a Universal Serial Bus (USB) flash memory drive), and then transferred from the removable memory storage device onto the set-top box **100** by connecting the removable memory storage device to a compatible I/O connection **130** on the set-top box **100**, for example, a USB port. Although discussed in terms of a USB flash drive, other modes of transferring playlist rules and media content are possible. For example, other forms of portable, non-volatile storage such as DVDs, CDs, tape or floppy disk or Memory Cards such as Compact Flash, Secure Digital Card, MultiMedia Card, SmartMedia, Memory Stick, Memory Stick PRO, xD-Picture Card or a Micro Drive might be used instead. In alternative embodiments where Internet connectivity is not possible, the back-channel media delivery system communicates with the backend server **180** via a modem or other data connection.

Turning to the playlist rules, many different rules can be specified, with the number and type of rules related to the capabilities of the set-top box **100** and environmental sensors **171**. An example of a simple playlist rule is one that is time based. For example, the content management system **111** can be instructed via a playlist rule to play a certain media selection according to the current time of day, day of the week, or a combination of the two. The rules can further specify a sequential, random or weighted randomization of media selections during a given time period. Different rules can be applied to different times of the day and on different days of the week. For example, supposing an embodiment of the invention were placed on a commuter train for playing advertisements or other media to commuters. In such a situation, the audience would be different during the rush hour commute than it would be, for example, at noon. Likewise, the audience on such a train would be different on the weekend than it would be during an ordinary mid-week work day. Playlist rules allow embodiments of the invention to be sensitive to these differences and enable an advertiser, for example, to tailor the selection and playback of media accordingly.

Another example of a playlist rule is one which specifies that the same media should not be repeated within a given period of time. In the commuter train example above, it is likely that almost the same audience would be on board the train from, for example, the suburbs into the city. Once the train has emptied at its destination, the playlist rules could

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permit the media selections to repeat because presumably, a new audience would be present to see the media content.

Playlist rules may also specify quotas for specific media with promotion or demotion of playback priority based on the number of impressions each media has received. For example, suppose a particular advertisement, 'ad A', is targeted to receive 100 impressions in a month. Suppose that 'ad B' is targeted to receive only 50 impressions per month. Further suppose that 'ad B' has already received 40 impressions while 'ad A' has received only 30. The content management system 111 may, in such a situation, boost the priority of 'ad A' so that it plays more frequently and likewise decrease the play priority of 'ad B' so it plays less frequently. In this way, the back-channel media delivery system can increase the likelihood that each advertisement will receive its targeted number of impressions. The play priority for any given piece of media may also be specified based on a premium service where advertisers, for example, pay a premium for more impressions or for playback priority.

In other embodiments, media can receive a higher playback priority because of its particular perishability. That is, certain media content is particularly time sensitive and in recognition of this, such media will receive a higher playback priority to hopefully increase the number of impressions. Examples of such media could involve sporting events (e.g., the Super Bowl), the season finale of a popular television show or media content related to an election.

More complex playlist rules can be used by the content management system 111 in conjunction with environmental data 123 provided by the environmental sensors 171. In one embodiment, the environmental sensors 171 act as traffic counters that simply count the number of persons passing in proximity to the back-channel media delivery system. The traffic count is provided as feedback to the back-channel media delivery system as was previously discussed. According to a particular rule, the content management system 111 may then prioritize the playback of specific media items or groups of media for playback during times of high traffic. It can also be specified in the playlist rules that the same media should not be played back-to-back. The playlist rules can also be used to have the content management system 111 prioritize specific media items or a group of media items to playback when the system senses a high traffic-count. A high-traffic count might be characterized in different ways. For example, the content management system 111 might consider passing a certain traffic-count threshold as "high-traffic." Alternatively, the content management system 111 could characterize a large change in traffic within a certain period of time as high traffic and ignore the raw number of traffic counts altogether.

Although traffic counting sensors are perhaps the most common type of environmental sensors 171, more sophisticated sensors are capable of sensing and measuring more complex data for use with more complex playlist rules and data gathering. For example, as previously discussed, some sensors are capable of measuring the dwell time of a person or persons within a proximity of the back-channel media delivery system. Such capability is useful for helping determine the efficacy of any given advertisement. For example, it is advantageous to know that while 'ad A' was watched by 10 persons, only 2 of them stay for the entire 30 second duration of the advertisement. This data is valuable if you also know that 'ad B' was also watched by 10 persons and 8 of them stayed for the entire 30 second duration of the advertisement. The simplest sensors would detect only proximity and determine how long a person or persons are in proximity to the back-channel media delivery system.

Another type of sensor could read the information stored in an RFID tag. Such a tag might be placed in products sold in a store. In one embodiment, the sensors in a back-channel media delivery system could determine what the quantity and type of products a person has in their shopping cart as they approach the system in a retail store. Such data could then be used to select media for playback that is tailored for that particular person and their buying habits. Alternatively, RFID tags could be placed in the name tags of persons attending a large convention. The RFID tag could store information about that particular persons area of expertise. The RFID tag could then be read as the person moves about the convention and media content that would be of interest to such a person could be adaptively rendered by a back-channel media delivery system as they pass by.

In yet another embodiment, environmental sensors could possibly detect the height and weight of a person in proximity to the back-channel media delivery system. Such information might be particularly useful especially when coupled with other information. Perhaps, for example, the playlist rules can be used to have the sensors 171 interpret a shorter, lighter person in front of the system during after-school hours between 3 and 5 P.M. to be children. In such instances, the playlist rules can further control the content management system to render media content intended for children.

Embodiments of the invention might also include one or more environmental sensors capable of tracking the attention of persons in proximity to the back-channel media delivery system. There are many possible configurations of attention tracking sensors. Some attention tracking sensors, for example, can track the attention of a subject through the measurement or detection of aspects of the subject's face. One such attention tracking sensor might, for example, use a camera and suitable illumination to capture images of an area in proximity with the back-channel media delivery system. Suitable processing of the images could be used to determine the locations of people within the image and in particular, where those people are actually looking. Such processing could, for example, detect whether a person is looking at the screen based on, for example, the angle of their facial features within the captured images. As is known in the art, there are complex algorithms such as the mean shift algorithm that allow for face recognition and face tracking and such algorithms may be advantageously employed in an attention tracking sensor.

Alternatively, methods exist for attention tracking based on tracking only on the eyes. A suitable eye tracking algorithm may process the captured images in order to determine whether the subject's eyes are pointed at the back-channel media delivery system. Attention tracking using only the eyes may be advantageous in certain lighting situations or where the particular illumination results in accentuation of the eyes within the captured images. Attention tracking using both the eyes and other aspects of the face or head may be advantageous since although a person's face may be generally facing the back-channel media delivery system, they may not be looking directly at the system. Instead, for example, they may be looking at something behind or to the side of the system. Use of eye tracking may thus permit attention tracking sensors to be more accurate. An attention tracking sensor incorporated into the embodiment depicted in FIG. 1A would allow the back-channel media delivery system to determine whether each individual in the defined field is looking at the display 150 from moment to moment.

Attention tracking sensors would permit embodiments of the back-channel media delivery system to gather information on how long each individual looks at the screen. Gather-

ing such information on a second-by-second basis permits gauging the effectiveness of a particular instance of media content, or different time segments within that instance, in getting and maintaining the attention of people. Likewise, through the use of an appropriate playlist rule, one embodiment of the back-channel media delivery system could dynamically alter rendering of media in response to changing interest in the media being rendered. For example, suppose a person is watching the display **150** of the embodiment depicted in FIG. **1A**. An attention tracking environmental sensor connected to such an embodiment could detect that the person is no longer paying attention or has averted their gaze in some manner, and that information could cause the system to start rendering a different instance of media. Alternatively, other embodiments of the system might change the volume of sound, change the brightness of the display, or other parameters of media playback in an attempt to regain the person's attention.

An attention tracking environmental sensor could also permit more accurate determination of a person's size, shape, height or the speed with which they move. Such information could be used by embodiments of the invention to generate probabilistic demographic information. Such information is useful and valuable in and of itself. Such information might also, however, be used by a playlist rule within an embodiment of the invention to custom tailor a media selection suitable for the person mostly likely to be watching the display at that moment.

In an embodiment, attention tracking environmental sensors may be used with face recognition algorithms to identify one or more persons in proximity with the back-channel media delivery system. Identification of the person or persons might employ many different face recognition algorithms as is known in the art. In an embodiment, the system compares the face or facial feature data detected by the attention tracking environmental sensors to face or facial feature data stored in, for example a database of faces and features. The database may be pre-populated with face data of particular persons of interest. Alternatively, the system may cross-reference 3rd party databases that contain face data. For example, the system could reference face data from the FBI's Ten Most Wanted list or face data of missing children from the Center for Missing Children. In this embodiment, the back-channel media delivery system may then also notify and assist local agencies when a person of interest is detected in the vicinity of the system. In addition to notification and assistance, the back-channel media delivery system may also be configured to raise a local alert by, for example, displaying the image of the person of interest on the screen (e.g., a missing child poster) and sounding an alarm.

Many types of environmental sensors must be properly, and perhaps continually, calibrated to provide accurate measurement. Embodiments of the invention may provide mechanisms for manual, automatic and/or continual calibration of the environmental sensors. For example, an embodiment of a back-channel media delivery system may initiate playback of a calibration tone periodically to calibrate an audio sensor within the system. Such a system with a video camera may, for example, be calibrated by having a calibration image within the field of view of the camera and initiating calibration procedures on the camera.

With further reference to FIG. **1A**, although the set-top box **100** is capable of functioning more or less autonomously using playlist rules and environmental data, the set-top box **100** may also periodically synchronize with the backend server **180**. The backend server **180** receives the playback history log file **124** and can also upload new media content

185 and playlist rules **186** to the set-top box **100**. Alternatively, the set-top box may continually communicate with the backend server **180** allowing the playback history to be communicated to the backend server **180** in real-time. The playback history log file **124** may be reformatted and exported as some digitally transmittable format prior to being transmitted to the backend server **180**. In some embodiments, the transmission makes use of HTTP over TCP/IP protocols between set-top box **100** and the backend server **180**, which could be connected via an Ethernet network. The connection could also be wireless using an 802.11x Wi-Fi network, Bluetooth connectivity, Cellular connectivity, radio frequency, or some variation thereof. The transmitted playback history log file **124** is collected, stored, and analyzed on the backend server **180** and available for various reporting functionality as needed by the user of the system. The backend server **180** is able to support the simultaneous collection of playback history log file **124** from multiple set-top boxes **100**. The playback history log files **124** are aggregated and processed by an analysis program **181** that executes on the backend server **180**. The analysis program **181** generates reports, and can further allow users to interactively query and view the imported playback history log file **124** and aggregated information.

FIG. **1B** depicts an embodiment of the back-channel media delivery system wherein the environmental data server **170** is integrated into the set-top box **100**. Such an embodiment obviates the need for network connections between the environmental data server **170** and the set-top box **100** as well as the need for separate server hardware for the environmental data server. In some embodiments, the environmental sensors **171** are likewise directly connected to the set-top box **100**. The functionality of these embodiments is otherwise identical to the embodiments discussed above.

Embodiments of the invention such as, for example, those pictured in FIGS. **1A** and **1B** may also incorporate mechanisms to detect and log error conditions that may arise within the system. One of more of the environmental sensors **171** may, for example, develop severe mechanical or electrical problems that require the attention of a repair technician. Alternatively, certain error conditions may arise that may be quickly remedied. For example, a video camera being used as an environmental sensor may detect insufficient light for proper recording. This could be due to low ambient lighting conditions or, for example, an obstruction place in or on the camera itself. Suitably programmed embodiments of the invention may log such errors and optionally transmit the log via the network, or other means, to a reporting station. Another embodiment may raise a local alert allowing personnel local to the system to effect a repair in some simple situations such as, for example, removal of the obstruction in front of the video camera environmental sensor as described above.

Embodiments of the invention may also incorporate a remote administration capability. An embodiment of a back-channel media delivery system will typically be located at a remote location such as a store or other public venue as discussed above. Costs associated with a technician making a service call to these locations may be considerable. To reduce or eliminate these costs, embodiments of the invention may be remotely monitored and administered. Such administration capability may include the ability to logon to the system through a network or other interface, examine and adjust system settings, monitor the environmental sensors and/or update playlist rules and media.

FIG. **2A** is a data flow diagram that describes the flow of data within the embodiment of system depicted in FIG. **1A**

above. Operation of this embodiment of the back-channel media delivery system typically begins with the content management system **111** determining the next media to render in accordance with the playlist rules **122**. The content management system **111** communicates the location of the next media to the media player system **112**. The media player system **112** retrieves the appropriate media file from the media content files **121** and then typically renders the media on, for example, the display screen **150**. When the media player system **112** begins to render the media, it generates a media playback begin event which is communicated to the logger program **114**. When the media player system **112** stops rendering that particular media, it generates a media playback end event that is also communicated to the logger program **114**.

While the media is being rendered, the environmental sensors **171** begin detecting impressions and generate count events which are communicated to the environmental data server **170**. The traffic count and type of traffic is passed from the environmental data server **170** to the logger program **114**. During the period of time between the media playback begin event and end event, the logger program **114** logs the media ID, the timestamp and the traffic count and other environmental data to the playback log file **124**. Periodically, the playback log will be exported to the backend server **180**.

FIG. **2B** is a data flow diagram that describes the flow of data within the embodiment of the system wherein the environmental data server **170** is integrated into the set-top box **100** and as depicted in FIG. **1B**. The data flow shown in FIG. **2B** is essentially the same as that of FIG. **2A** except that the environmental sensors **171** communicate directly with set-top box **100** and its integrated environmental data server **170**.

FIG. **2C** is a data flow diagram of an example embodiment of a back-channel media delivery system where the collected environmental data is used as feedback to help determine the next media to play. During the time that the media player system **112** is rendering a media content file and the logger program **114** is likewise creating the playback history log **124**, information about the traffic count and other environmental feedback is communicated back to the content management system **111**. This feedback is used in conjunction with the playlist rules **122** to determine the next media content to render. The data flow depicted in this Figure is otherwise identical to that of FIG. **2A**.

FIG. **3** shows a flow chart diagram for one implementation of the log media playback history routine **301** of the logging system **114**. A media playback event is received from the media player system **112** at step **302**. The logging system **114** checks the playback event type at step **303**. If the playback event type is a "Play Start" event, the event details are written to the log file at step **304**, including the media identifier and timestamp T**1** information. The timestamp T**1** is stored in memory at step **305** for use later when a "Play End" event is received. The routine ends **310**. If the playback event type is a "Play End" event, the timestamp T**1** that was stored in memory is retrieved at step **306**. Environmental sensor count data for the time interval between timestamp T**1** and the current timestamp T**2** is retrieved from the environmental data **123** at step **307**. The event details are written to a playback history log file **124** at step **308** including the media identifier, the timestamp T**2**, and environmental sensor count data. Once the playback history log file **124** has been completed, it may be exported to the backend server **180** for further analysis.

FIG. **4** depicts a high level block diagram back-channel media delivery system according to one embodiment of the invention. Although FIG. **4** illustrates a particular embodi-

ment, it will be understood that alternative embodiments are possible as is evident from the embodiments and variations described above. The back-channel media delivery system **400** includes a media delivery device **410** and a backend server **440**. The media delivery device **410** includes a computing device **420**. The media device **410** also includes environmental sensors **415** and a rendering device **425** coupled to the computing device **420**. The computing device **420** selects media stored on the computing device **420** for rendering on the rendering device **425**. Alternatively, the computing device **420** may select media stored elsewhere. The computing device **420** then renders the media on the rendering device **425**. While rendering the media, the computing device **420** gathers environmental data from the environmental sensors **415**. The computing device **420** compiles the playback history **435** and transmits this history that is received by the backend server **440**. As was discussed more fully above, the backend server **440** is used to process and analyze the back-channel data. From this data, new playback rules may be devised for use by the media delivery device **410** during future renderings of new media on the rendering device **425**. New media and playback rules **430** are then transmitted to the media delivery device **410**. It will be understood that receiving the playback history **435** by the backend server **440** and sending the new media and playback rules **430** to the media delivery device **410** may be accomplished in numerous ways. For example, and as was discussed more fully above, the communication may take place via various types of wired or wireless connections or via non-volatile media.

From the foregoing it will be appreciated that, although specific embodiments of the invention have been described herein for purposes of illustration, it will be understood by one skilled in the art that various modifications may be made without deviating from the invention. Accordingly, the invention is not limited except as by the appended claims.

What is claimed is:
1. A media playback system comprising:
at least one rendering device;
at least one environmental sensor including an RFID sensor configured to detect RFID tags;
at least one environmental data server; and
a computing device including a storage device and coupled to the at least one rendering device, the at least one environmental data server, and the at least one environmental sensor, the computing device configured to:
select an instance of media stored in the storage device;
render the instance of media on the at least one rendering device; and
while rendering the instance of media, gather environmental data using the at least one environmental sensor to be provided to the environmental data server; and
wherein the environmental data server is configured to verify the environmental data and further configured to determine a number of instances RFID tags were detected and respective RFID tag identifiers, determine a number of the instances RFID tags were detected that are associated with the respective individuals who should not be included in the environmental data based on their respective RFID tag identifiers, and omit from the environmental data the number of instances RFID tags were detected associated with individuals who should not be included in the environmental data.
2. The media playback system of claim **1** wherein the environmental data server is further configured to verify the environmental data by at least one of:

detecting fraudulent environmental data, detecting invalid
duplicate environmental data, and detecting environ-
mental data corresponding to predetermined environ-
mental data that should not be gathered.

3. The media playback system of claim 1 wherein the
computing device is configured to provide the environmental
data for manual inspection and the record of the environmen-
tal data is based on the inspection.

4. The media playback system of claim 1 wherein the
computing device is further configured to cross-reference the
environmental data with a database containing identity data
for persons of interest.

5. The media playback system of claim 1 wherein the
computing device is further configured to calibrate the at least
one environmental sensor.

6. The media playback system of claim 1, wherein the
computing device is further configured to gather audit data
and store a record of the audit data.

7. The media playback system of claim 6 wherein the
computing device is configured to gather audit data by cap-
turing images of the vicinity of the at least one rendering
device to confirm the environmental data gathered using the at
least one environmental sensor.

8. The media playback system of claim 6 wherein the
computing device is configured to provide the environmental
data for manual inspection and the record of the environmen-
tal data is based on the inspection.

9. The media playback system of claim 6 wherein the
computing device is further configured to cross-reference the
environmental data with a database containing identity data
for persons of interest.

10. The media playback system of claim 6 wherein the
computing device is further configured to calibrate the at least
one environmental sensor.

11. The media playback system of claim 1 wherein the
computing device is further configured to detect and log
system errors of the media playback system.

12. The media playback system of claim 11 wherein the
computing device is configured to provide the environmental
data for manual inspection and the record of the environmen-
tal data is based on the inspection.

13. The media playback system of claim 11 wherein the
computing device is further configured to cross-reference the
environmental data with a database containing identity data
for persons of interest.

14. The media playback system of claim 11 wherein the
computing device is further configured to calibrate the at least
one environmental sensor.

15. The media playback system of claim 1 wherein the
computing device is further configured to:
identify playback time information at which the instance of
media was rendered;
provide the playback time information to a remote device;
and
correlate the playback time information at which the
instance of media was rendered with the environmental
data.

16. The media playback system of claim 1 wherein the
computing device is further configured to aggregate and cor-
relate a rendering time at which the instance of media is
rendered on the at least one rendering device and the environ-

mental data is received from the environmental sensor during
rendering of the instance of media.

17. The media playback system of claim 16 wherein the
computing device logs at least one of an identification of
rendered advertising media and the time at which the instance
of media is rendered.

18. The media playback system of claim 16 wherein the
computing device is physically separate from the at least one
rendering device.

19. The media playback system of claim 16 wherein the at
least one rendering device is further configured to provide the
time at which instance of media is rendered.

20. The media playback system of claim 19 wherein the
computing device includes a data logging system coupled to
receive the time at which the instance of media is rendered
and the environmental data to correlate the time of rendering
with the environmental data.

21. The media playback system of claim 16 wherein the
computing device comprises the environmental data server.

22. The media playback system of claim 16 wherein the
environmental sensor is configured to sense at least one
impression during rendering of the instance of media.

23. The media playback system of claim 22 wherein the at
least one impression comprises at least one of tracking human
impressions, impression dwell time, tracking attention, or
length of time of attention.

24. The media playback system of claim 1, further com-
prising:
a data logging system configured to correlate a time at
which the instance of media is rendered and the environ-
mental data gathered during the rendering of the
instance of media and generate log files, and
a server coupled to the at least one rendering device and the
data logging system, the server configured to receive and
analyze information in the log files to provide informa-
tion related to playback of the instance of media.

25. The media playback system of claim 24 wherein the
environmental data comprises at least one of tracking human
impressions, impression dwell time, tracking attention, or
length of time of attention.

26. The media playback system of claim 24 wherein the at
least one rendering device is further configured to provide the
data logging system the times at which the instance of media
is rendered.

27. The media playback system of claim 24 wherein the
server is further configured to provide rules for rendering the
instance of media to the at least one rendering device.

28. The media playback system of claim 24 wherein the
data logging system is further configured to synchronize with
the server.

29. The media playback system of claim 24 wherein the at
least one rendering device is a separate device from the com-
puting device.

30. The media playback system of claim 24 wherein the
server and the data logging system are separate devices.

31. The media playback system of claim 24 wherein the
server is coupled to the computing device and configured to
provide the environmental data to the data logging system.

32. The media playback system of claim 24 wherein the
server and the computing device are separate devices.

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